

Claims

1. An electronic package (10) comprising:
  - a circuit board (12) having a substrate (14) and circuitry (16);
  - a surface mount device (22) having a contact terminal (24);
  - 5 a mounting pad (28) formed on the circuit board (12); and
  - a solder joint (30) connecting the contact terminal (24) of the surface mount device (22) to the mounting pad (28) on the circuit board (12), the solder joint (30) comprising a reflowable solder and a plurality of stand-off members (32 or 42) disposed in the solder, wherein the plurality of stand-off members (32 or 42) provide a separation distance (H) between the circuit board (12) and surface mount device (22) in the range of about 0.01 mm to 10 0.10 mm.
2. The electronic package as defined in claim 1, wherein 15 the plurality of stand-off members (32 or 42) consumes in the range of about 0.001 to 5% of total volume of the solder joint (30).
3. The electronic package as defined in claim 1, wherein 20 the plurality of stand-off members (32 or 42) have an affinity for solder.
4. The electronic package as defined in claim 1, wherein the plurality of stand-off members (32) each comprise a hollow member (34) having an outer surface (38) with an affinity for solder.
- 25 5. The electronic package as defined in claim 4, wherein the hollow member (34) comprises a conductive outer surface (38).
- 30 6. The electronic package as defined in claim 5, wherein the conductive outer surface (38) comprises a high temperature solder material having a reflow temperature higher than a reflowable temperature of the solder.

7. The electronic package as defined in claim 1, wherein the plurality of stand-off members (42) each comprises an irregularly shaped particle.

5 8. The electronic package as defined in claim 1, wherein the plurality of stand-off members (32 or 42) each comprises a high temperature solder material having a reflow temperature higher than a reflow temperature of the reflowable solder.

10 9. The electronic package as defined in claim 1, wherein the surface mount device (22) comprises an electronic device having electrical circuitry.

15 10. The electronic package as defined in claim 1, wherein the plurality of stand-off members comprises at least three stand-off members disposed between the contact terminal and the mounting pad.

11. The electronic package as defined in claim 1, wherein the separation distance (H) is in the range of about 0.01 mm-0.03 mm.

20 12. A method of forming an electronic package (10) having a controlled height stand-off distance (H) between a surface mount device (22) and a circuit board (12), said method comprising:

25 providing a circuit board (12) having a substrate (14) and circuitry (16);  
forming a mounting pad (28) on the circuit board (12);  
providing a surface mount device (22) having a contact terminal (24);  
30 forming a mixture of reflowable solder and a plurality of stand-off members (32 or 42), wherein the plurality of stand-off members (32 or 42) each comprises a dimension in the range of about 0.01 mm to 0.10 mm; and

5 forming a solder joint (30) with the mixture to connect the contact terminal (24) of the surface mount device (22) to the mounting pad (28) on the circuit board (12), wherein the circuit board (12) and surface mount device (22) are separated by distance (H) in the range of about 0.01 mm to 0.10 mm.

10 13. The method as defined in claim 12, wherein the plurality of stand-off members (32 or 42) consumes in the range of about 0.001 to 5% of total volume of the solder joint (30).

15 14. The method as defined in claim 12, wherein the step of forming the solder joint (30) comprises heating the mixture to an elevated solder temperature and bringing the heated mixture into contact with the contact terminal (24) and the mounting pad (28).

20 15. The method as defined in claim 14, wherein the solder temperature is below a reflow temperature of the plurality of stand-off members (32 or 42).

25 16. The method as defined in claim 12, wherein each of the plurality of stand-off members (32 or 42) has an affinity for solder.

17. The method as defined in claim 12, further comprising the step of forming the plurality of stand-off members (32) as a hollow member having an outer surface with an affinity for solder.

20 18. The method as defined in claim 12, further comprising the step of forming the plurality of stand-off members (42) into irregularly shaped particles.

30 19. The method as defined in claim 12, wherein the separation distance H is in the range of about 0.01 mm-0.03 mm